

EPA REGION 4 VIRGINIA-CAROLINA CHEMICAL PHOSPHATE/FERTILIZER INITIATIVE

A FRAMEWORK FOR INTEGRATED SITE ASSESSMENT AND RESPONSE ACTION

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OVERVIEW

In July 2000, the Waste Division of the United States Environmental Protection Agency - Region 4 began working collaboratively with ExxonMobil Corporation to resolve outstanding environmental issues associated with historical operations of the former Virginia-Carolina Chemical (VCC) Corporation. A conceptual framework was mutually developed that involved integrated site assessment and response action utilizing the authorities of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The framework is a proactive strategy to inventory, prioritize, and implement adequately protective response actions where warranted, using a two-phased approach.

Phase I has been completed, and involved developing an inventory, or site universe, of former VCC facilities utilizing existing information provided by EPA, and new information generated by consultants retained by ExxonMobil. The initial VCC site inventory list was submitted to EPA in a report dated January 16, 2001. Phase II will begin in summer 2001, and will involve site characterization and cleanup activities on those sites where warranted using Time-Critical Removal Actions (i.e., Interim Actions), Non-Time Critical Removal Actions, and other NPL equivalent actions.

A total of 40 former VCC facilities in the eight State region was identified by ExxonMobil in the January 16, 2001 report. A refinement of the VCC site universe was conducted by EPA to determine the facility location, verify the process descriptions provided by ExxonMobil, and establish an initial priority.

BRIEF HISTORY OF THE INDUSTRY AND DESCRIPTION OF THE MANUFACTURING PROCESS

Phosphate/fertilizer manufacturing in the southeastern United States began in the 1880's, and prospered through the mid-1970's. The Virginia-Carolina Chemical Company (VCC) was one of the leading companies to produce nitrogen-phosphorus-potassium agricultural fertilizer using the lead chamber process. In the early years of production before 1925, phosphate ore was mined locally and transported to the facility by barge or rail as the source of phosphorus. Locally mined phosphate was later replaced by ore from the vast deposits near Tampa, Florida area. Prior to 1935, iron pyrite ore (FeSO_2) was transported to the facility and used as the source of sulfur. In addition to sulfur compounds, the pyrite ore also contained other inorganic constituents such as



arsenic, selenium, copper, nickel, cobalt, thallium, and gold. By 1920, elemental sulfur had replaced iron pyrite as the source of feed stock at 80% of these facilities. In the early to mid 1900's, the contact process was used to manufacture a much stronger sulfuric acid than was possible using the chamber process. Due to the high demand for the stronger sulfuric acid, the chamber process was eventually replaced by the contact process.

The first component of the fertilizer manufacturing process was the production of sulfuric acid using the lead chamber process. The iron pyrite ore was burned in the presence of oxygen to produce sulfur trioxide (SO_3). The sulfur trioxide gas (SO_3) was then reacted with water mist (H_2O) by passing through a building known as the Glover tower to produce sulfur oxides. The sulfur oxides, water, and oxides of nitrogen were then combined in the lead-lined chambers to make sulfuric acid. The lead chambers were typically rectangular-shaped vessels made of sheet lead. Lead was commonly used as a construction material and an insulator at these facilities due to its resistance to corrosion. Each facility usually had three to six chambers, and the chambers varied in size from 50 to 150 feet long, 16 to 26 feet high, and 20 to 30 feet wide. After leaving the acid chambers, the concentration of the acid was increased by re-circulation through the Glover Tower countercurrent to the sulfur trioxide gas. After the sulfuric acid left the Glover Tower, it was typically cooled in water-jacketed lead tubs filled with lead-cooling coils.

The second component of the fertilizer manufacturing process was the storage/granulation/bagging operation. The phosphate rock was crushed, ground, and mixed with the sulfuric acid in a reaction vessel to produce a soluble form of phosphoric acid. The phosphoric acid was dried and transferred to a storage area for curing. After curing, the phosphoric acid was crushed and screened. The processed phosphoric acid was mixed with ammonia (for nitrogen) and potash (for potassium) to produce nitrogen-phosphorus-potassium fertilizer.

CHARACTERISTICS OF PHOSPHATE/FERTILIZER FACILITIES

The former acid-producing facilities have several characteristics in common. Visual observation of these facilities typically reveals reddish purple- to dark brown-colored soil in the area where the acid chambers and iron pyrite furnaces were located. Elemental sulfur is sometimes visible in the soil, as well as ceramic packing materials from the cooling/concentrating towers. The two principle soil contaminants at the former VCC facilities are lead and arsenic. It is common to find lead concentrations in soil up to 20,000 mg/kg and arsenic concentrations in soil in excess of 6,000 mg/kg. Elevated levels of other inorganic constituents such as selenium, copper, thallium, and zinc are also common in soil. Elevated levels of lead and arsenic in sediment and groundwater are common in the area around the acid chambers. Acidic pH values between 2.0 and 3.0 normally exist in the soil, groundwater, and sediment around the acid chambers. These low pH conditions tend to increase the solubility and mobility of the inorganic constituents in these source areas. Contaminant releases from surface water run-off and discharge of shallow ground water into nearby coastal water estuary systems containing extensive wetlands, fisheries and threatened species habitat are the principle concerns at some of the former VCC facilities. High levels of lead and arsenic in soil and groundwater also present a significant human health concern at some of these facilities.

SUMMARY OF TWO-PHASED APPROACH

PHASE I

Phase I of the Initiative has been completed. A total of forty (40) former VCC facilities were identified by Exxon Mobil and EPA using information sources such as the Commercial Fertilizer Yearbooks, VC Chemical annual summary reports, Polk's Directories, and Sanborn Fire Insurance maps.

Of the 40 facilities identified, sixteen (16) have been recommended for no further action because Sanborn maps for these facilities indicate they did not produce sulfuric acid. Therefore, these facilities should not have the contamination associated with the lead acid chamber process. The remaining twenty four (24) facilities did manufacture sulfuric acid. Of these facilities, nine (9) facilities have been identified as high priority further action, and fifteen (15) facilities have been recommended for low priority further action.

PHASE II

Phase II of the Initiative is scheduled to begin in June 2001. Phase II will first involve conducting a site reconnaissance visit to screen the nine (9) facilities identified as high priority further action, followed by site visits to screen the remaining fifteen (15) facilities identified as low priority further action.

Much of the work typically required for both pre-Remedial and Remedial Investigation is not warranted, given the level of understanding about the phosphate/fertilizer manufacturing process, the contaminants associated with these facilities, and the fate and transport of the contaminants. For this reason, a site characterization strategy will make use of standardized work plans and sampling investigation to produce quality environmental data in a timely manner. This data will effectively replace the data normally collected during the pre-Remedial and Remedial processes. Investigating contaminant distribution using the site characterization strategy will take less time and cost less money than the traditional pre-Remedial and Remedial Investigations.

The Initiative will utilize a presumptive remedy approach to address those facilities where additional response action is warranted. Time-critical and non-time-critical removal actions will be implemented when needed to remove as much source contamination as possible. Treatment technologies such as Permeable Reactive Barriers (PRBs) will be evaluated to address ground water contamination, and options for addressing sediment contamination will also be evaluated and implemented if warranted. Once the necessary response action(s) have been completed, a risk assessment will be conducted to determine the level of risk remaining at the facility. Additional response action(s) would be implemented whenever warranted to ensure protection of human health and the environment as required by CERCLA.

BENEFITS OF USING THE INITIATIVE

The Initiative will use a management approach which is more productive and cost effective than addressing all 40 facilities on a site-by-site basis. Instead of assigning individual SAMs and RPMs to discover and conduct the traditional pre-Remedial and Remedial Investigations for each facility, a dedicated team of experienced EPA and Exxon Mobil personnel will focus on collecting an adequate amount of site characterization data needed to develop and implement response actions that are protective of human health and the environment as defined by CERCLA. The EPA personnel on the team include two Remedial Project Managers (RPMs), an On-Scene Coordinator (OSC), two attorneys, and one former Site Assessment Manager familiar with the site assessment process. Using the team approach will provide greater consistency in the day-to-day communications between EPA, Exxon Mobil, and State personnel, and provide greater consistency in decision-making.

The project team will use existing AOCs developed for the VCC facilities in Charleston, SC, as models for the remaining VCC facilities. Instead of assigning a different attorney and remedial project manager to develop and negotiate an AOC for each facility, the project team will use the model AOCs to minimize any duplication of effort, therefore reducing the amount of time required to complete AOC negotiations.

Based on the knowledge gained about the contamination at several phosphate/fertilizer facilities in Region 4, and the effectiveness of the remedies being implemented at those facilities, presumptive remedies will be used whenever possible to address the remaining VCC facilities. Using a presumptive remedy approach will not only expedite remedy selection and implementation, but build consistency in decision-making.

CONCLUSIONS

EPA Region 4 and Exxon Mobil are currently working on the phosphate/fertilizer Initiative to address 40 former VCC facilities. The framework for the Initiative is a stream-lined strategy to inventory, prioritize, and implement adequately protective response actions where warranted, using a two-phased approach. The Initiative provides an excellent opportunity for EPA Region 4 to work with a cooperative PRP, and use a stream-lined management approach to address contamination at former VCC facilities in a productive and cost effective manner.